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FACULTY OF GRADUATE STUDIES  
The undersigned certify that they have read, and  
recommend to the Faculty of Graduate Studies for accept-  
ance, a thesis entitled "Correlates of Reflection-  
Impulsivity" submitted by Prem Kumar Gupta in partial  
fulfilment of the requirements for the degree of Master  
of the University.  
BY  
PREM KUMAR GUPTA



A THESIS  
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES  
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DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA  
SPRING, 1970





UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Correlates of Reflection-Impulsivity" submitted by Prem Kumar Gupta in partial fulfilment of the requirements for the degree of Doctor of Philosophy.



## ABSTRACT

Kagan (1965a, 1966c) has repeatedly emphasized the importance of reflection-impulsivity (R-I) for education. The main purpose of the present study was to determine relationships between a measure of R-I, Matching Familiar Figures, and several cognitive and personality variables.

Several predictions were made concerning the relatedness of R-I to verbal ability, school achievement, mental speed, analysis, extraversion, neuroticism, risk taking, anxiety, locus of control, agreeing response set, impulsiveness, persistence and socio-economic status.

A battery of tests was administered to 217 high school students. The MFF was individually administered to all the subjects. On the basis of MFF latency and MFF errors scores two groups of subjects, reflective and impulsive, were identified. The reflective group had significantly higher verbal ability, demonstrated greater persistence and showed better achievement in school subjects.

Little support was found for the prediction concerning a strong common factor of R-I in terms of high loadings of most of the variables. Not only did the personality variables fail to load on the reflection factor, but they loaded on strong meaningful factors that were independent of the reflection factor. In addition to reflection, five other independent factors (anxiety, impulsiveness,



achievement-persistence, integrative complexity and incorrect speed) were identified.

It was suggested that R-I is a domain specific variable and it is not related to established personality constructs.

Generally two indices, response latency and number of errors, are jointly employed to identify reflective and impulsive subjects. Response latency has been considered as the more important or the major index of R-I. Since the minor index of R-I, number of errors, showed a consistent tendency for stronger relationships with other variables than did the major index, response latency, it was suggested that the operational definition of R-I is in need of further consideration.





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## CHAPTER I

### BACKGROUND TO THE STUDY

#### Reflection-Impulsivity

Kagan, Rosman, Day, Albert and Phillips (1964) have developed a new construct, reflection-impulsivity. The relationships of reflection-impulsivity with personality and cognitive variables are not clear (Kagan et al, 1964). According to Kagan (1965a) reflection-impulsivity has a functional association with performances, especially those of educational significance. It was thought that a systematic exploration of relationships between a measure of reflection-impulsivity and measures of several established personality and cognitive variables might be of some scientific value.

Cronbach and Meehl (1955) support the contention stated above in the following statement:

"Learning more about" a theoretical construct is a matter of elaborating the nomological network in which it occurs, or of increasing the definiteness of the components. At least in the early history of the construct the network will be limited, and the construct will as yet have few connections (p. 290).

The purpose of the present study was to realize the objectives of "elaborating the network" and "increasing the definiteness of the components" of reflection-impulsivity.

Much work has been done on impulsiveness in the area of personality and scales measuring impulsiveness, restraint, or impulse control exist in the current personality





inventories. The Guilford-Zimmerman Temperament Survey (1949) contains a scale on restraint, the Cattell 16 Personality Factor Questionnaire (Cattell et al, 1957) has a scale measuring enthusiasm, while Thurstone Temperament Schedule (1953) contains a measure of impulsiveness. Twain (1957) found five factors of impulsiveness in a factor analytic study of various aspects of impulsivity. Barratt (1965) factor analyzed scores on Guilford-Zimmerman, Cattell's 16 Personality Factor and Thurstone Temperament along with scores on his own (Barratt) scale of impulsiveness. He found that his scale and scales of impulsiveness in the three above-mentioned inventories loaded heavily on the same factor. Characteristic items on a scale of impulsiveness are:

- (1) I act on the spur of the moment without thinking things over.
- (2) I often say things and later regret them (Guilford, 1959, p. 412).

### Definition of Reflection

Kagan et al (1964) define reflection as "the tendency to reflect over alternate solutions or classifications in situations in which several response alternatives are available simultaneously." Reflection involves, essentially, assessing the validity of competing solution hypotheses and evaluating the suitability of the finally accepted hypothesis (Kagan, 1966b). Kagan's "reflection", thus, is closely related to restraint and non-impulsiveness, as defined in



the personality inventories, except that the availability of several solution hypotheses is a necessary condition of its measurement.

### Operationalization of Reflection-Impulsivity

As stated above, Kagan defines reflection as the tendency to consider alternative solutions in problems with high response uncertainty. Response uncertainty is an essential element in the definition. In a situation where only one response is available to the respondent, the response uncertainty is minimal and consequently the response latency would not be an adequate measure of reflection-impulsivity. Standard measures of this reflection-impulsivity have generally consisted of two scores derived from tasks where the subject is required to match a standard stimulus with an identical stimulus present in an array of highly similar stimuli. The two scores are: response latency (decision time) and number of errors. Response latency is the major operational index of a subject's standing on the dimension of reflection-impulsivity and it is the time taken in giving the first response on such tasks. This index alone can be used to classify subjects as reflectives or impulsives. Number of errors, however, is the minor index and it is the number of wrong responses made before a subject finds the identical (correct) stimulus. Response latency and number of errors correlate negatively



with each other. Subjects who take longer make significantly fewer mistakes. Although Kagan has used response latency alone to identify reflectives and impulsives in some studies, he recommends (1965c) the joint use of both response latency and number of errors to identify more clearly reflectives and impulsives.

Those who score above the median on response latency and below the median on number of errors are classified as reflectives while those who score below the median on response latency and above the median on number of errors are impulsives. This procedure of classification, however, leaves a large part of the sample unclassified. This unclassified part of the sample consists of quick-responding individuals with few errors and slow individuals with many errors. A secondary purpose of this study was to determine how these unclassified members of the sample, largely ignored by Kagan, differ from reflective and impulsive persons.

#### Antecedents of Reflection-Impulsivity

Kagan (1965a) has hypothesized three factors that may singly or collectively account for individual differences in reflection impulsivity (R-I): (a) constitution, (b) motivation or extent of involvement, and (c) degree of emphasis on quick success versus possible failure. One of the three determinants of R-I, "quick success versus possible failure", may be generated by two relatively incompatible



social demands: "Get the answer quickly" and "Do not make a mistake". An impulsive child is more oriented towards getting the answer quickly and is a high risk-taking person while a reflective child puts premium on not making the mistake and is a low risk-taking person.

### Correlates of Reflection-Impulsivity

Some attempts have been made to find correlates of reflection-impulsivity (Kagan, 1965a, 1966a, 1966b). According to these findings impulsives make significantly more errors in reading and word recognition tasks and are more likely to offer incorrect solutions on inductive reasoning and visual discrimination tasks. As revealed by the life histories of a number of ten year old children, the reflective children demonstrate higher standards of mastery of intellectual tasks and persist longer on these tasks; have stronger tendency to avoid interaction with peer group members and carefully watch the group for the first few days of school before participating in group activities (Kagan, 1965a). Reflectives also show a consistent tendency to avoid dangerous situations and tend to possess slightly better verbal skills, as compared with impulsive children (Kagan, 1965a). Bernstein (1961) has identified two forms of communication codes: restricted and elaborated. Restricted codes lack in specificity and exactness. Sentences are simple, short and often incomplete.





According to Hess and Shipman (1965) "the basic quality of this mode is to limit the range and detail of concept and information involved." Elaborated codes, on the other hand, are those in which the message is specific and individualized. These codes allow greater flexibility of expression and higher degree of discrimination among cognitive and non-cognitive content. Hess and Shipman (1965) have found that modes of communication (elaborated or restricted), family control systems (status oriented or person oriented) and maternal teaching styles are related to reflection-impulsivity. These authors also found that mothers as well as children from high socio-economic status groups are less impulsive as compared with mothers and children from low socio-economic status groups. There is no mention of whether the differences are significant or not.

These authors used the Sigel Sorting Task in which subjects are required to make twelve consecutive sorts of figures placed in prearranged random order. After each sort they are asked to give their reason for putting certain figures together. The responses are classified into four categories. The number of times a subject's responses fell into a relational-contextual category was used as an index of impulsiveness. Shaefer and Bayley (1963) and Kagan (1965d) report that there is a significant negative correlation between vigour of motor activity and attention. Studies of the life histories of children (Kagan, 1965a) reveal that



children displaying more vigorous motor activity are more likely to be impulsive. Some evidence also exists to show that reflective persons condition more intensely as measured by resistance to extinction in terms of GSR deflection, are more likely to belong to a higher socioeconomic group (Campbell, 1968) and show better persistence with difficult tasks (Kagan, 1965a). In addition to the correlates of reflection-impulsivity mentioned above, there are many other dimensions in personality and cognition that are likely to be related to this variable.

On the basis of previous findings fifteen variables were selected to elaborate the network of relationships of reflection-impulsivity and to determine the relative significance of the two components, response latency and number of errors. From the point of view of construct validation (Cronbach and Meehl, 1955), building of an appropriate network is of great value in clarifying the construct.

#### Reflection-Impulsivity and Personality Variables

Investigation of the relationship between R-I and the following personality variables was conducted: (a) extraversion, (b) risk taking, (c) locus of control, (d) agreeing response set, (e) impulsiveness, (f) anxiety, (g) neuroticism, and (h) persistence. The rationale for the inclusion of each of these variables is outlined below.



### Extraversion-Introversion and Reflection-Impulsivity

The key elements in the definitions of extraversion and introversion are very pertinent to this link. According to Eysenck and Rachman (1965, p. 19) the extravert "... is sociable, likes parties, has many friends and is generally an impulsive individual ...", while an introvert "... mistrusts the impulse of the moment, 'looks before he leaps' ...". Eysenck (1967a), on the basis of Jensen's work (1964), reports that extraverts solved the problems in the Raven's Progressive Matrices test of intelligence significantly faster than the introverts and made more errors, though the differences in errors did not reach the accepted significance level. Eysenck (1967b) mentions several studies that demonstrate the relationship between extraversion and speed. The following statement from Eysenck (1967a) suggests a very close parallel between reflection-impulsivity and extraversion-introversion.

One of the earliest findings relating to extraversion/introversion was that extraverts opt for speed, introverts for accuracy, when there is the possibility of choice in the carrying out of an experimental task (p. 92).

Besides the two common elements of speed and accuracy we find that Eysenck's "possibility of choice" is very similar to Kagan's "response uncertainty". We have already observed that reflective children show better task mastery as well as persistence on intellectual tasks. Parallelling



that finding, Eysenck and Rachman (1965) report that introverts show significantly better persistence and higher levels of aspiration. Even with respect to conditioning, reflectives (Campbell, 1968) and introverts (Eysenck and Rachman, 1965) are similar in that both condition more intensely and take longer on extinction.

### Risk Taking and Reflection-Impulsivity

Kagan believes that reflective subjects are low risk takers whereas impulsive subjects are high risk takers (1965a). It makes intuitive sense that reflective subjects would take rather conservative risks because of their tendency to spend time in the evaluation of the consequences.

### Impulsiveness and Reflection-Impulsivity

The MFF, as a measure of reflection-impulsivity, is free from any subjectivity. Both response latency and number of errors can be recorded completely objectively. In a study of this kind it is desirable (Campbell and Fisk, 1959) to see how impulsiveness as measured by a self-report type instrument relates to reflection-impulsivity as measured by latency and errors.

### Locus of Control and Reflection-Impulsivity

Rotter has suggested (1954) that the performance of an individual on a task is affected by: (1) individual expectations as to whether the outcomes are the result of





luck or skill, and (2) the value that the individual places on the outcomes. Internally controlled people view themselves as active causal agents, whereas those externally controlled believe that they are passive recipients of effects. People with predominantly internal control of reinforcement take longer on difficult problems (Julian and Katz, 1968) and are more likely to belong to higher socio-economic groups as compared with those with predominantly external control (Franklin, 1963). A person who believes that the outcome of his behavior is a matter of skill is more likely to apply the skill with greater care in solving a problem and so delay his response in trying to find the correct response.

#### Agreeing Response Set and Reflection-Impulsivity

Couch and Keniston (1960) developed a relatively content-free scale to measure agreeing response set. The scale places subjects on a "yeasayer-naysayer" continuum. Descriptions of "yeasayers" and "naysayers" are of particular interest here. On the basis of the correlations of the Response Agreement Set with the Minnesota Multiphasic Personality Inventory Couch and Keniston (1960) observe:

Yeasayers seem to be "id-dominated" personalities with little concern about or positive evaluation of an integrated control of their impulses. They say they express themselves freely and quickly. Their psychological inertia is very low, that is, very few secondary processes intervene as screen between underlying wish and overt behavior response....



The 'disagreeing' naysayers have the opposite orientation. For them, impulses are seen as forces requiring control and perhaps, in some sense, as threat to general personal ability. The naysayer wants to maintain inner equilibrium.... We might describe this as state of high psychological inertia-impulses undergo a series of delays, censorship and transformations before they are permitted expression (pp. 163-164).

Couch and Keniston (p. 164) attribute to "naysayers" an attitude of stimulus rejection -- "a pervasive unwillingness to respond to impulsive or environmental forces". Messick and Fritzky (1963) report a significant correlation of .42 between the Barratt Impulsiveness scale and the Response Agreement scale. In view of the descriptions of "yeasayers" and "naysayers", it seems that the inclusion of this variable in the network would be relevant.

#### Anxiety and Reflection-Impulsivity

It has been suggested by Kagan et al (1964) that anxiety may be a strong factor in impulsive behavior. According to these authors an impulsive child finds it hard to delay the response as he fears that any delay may be interpreted by the examiner as an evidence of his inability. This anxiety about his ability would result in quick responding. On the other hand a minimally anxious child, who is confident about his ability, can tolerate the delay and select reflectively. Since the Eysenck Personality Inventory yields scores on neuroticism in addition to extraversion it was decided to include this variable in the



network mainly for exploratory purposes.

### Persistence and Reflection-Impulsivity

It has already been observed that reflective children are significantly more persistent on difficult tasks than impulsive children. The latter group should find it difficult to persist on difficult tasks because it requires delaying the response. Furneaux's Level Test is a measure of persistence (Furneaux, 1960).

### Reflection-Impulsivity and Cognitive Variables

The following cognitive variables were selected:

(a) mental speed, (b) verbal ability, (c) school achievement, (d) integrative complexity, and (e) analytic tendency. The rationale for their inclusion in the study is given below.

### Mental Speed and Reflection-Impulsivity

According to Furneaux (1960) there are at least three relatively independent determinants of problem solving ability: speed, accuracy and persistence. Although impulsive people, by definition, have short response latencies, it was thought appropriate to see how a mental speed variable, by Furneaux, is related to R-I.

### Verbal Ability and Reflection-Impulsivity

Kagan (1965a) reports that reflective children have a tendency to possess slightly better verbal ability than impulsive children. Shipman and Hess (1965) also suggest,



on the basis of Bernstein's (1961) theory, that elaborated modes of communication are likely to result in reflection. It is safe to assume that elaborated codes would have functional relationship with verbal ability. In view of this evidence it became desirable to add verbal ability to the network.

### School Achievement and Reflection-Impulsivity

Kagan has repeatedly stressed the importance of R-I for education (e.g. 1965a, 1966a). His position is that impulsive children are subject to frustration and ridicule as a consequence of their habit of giving obviously incorrect answers. Since teachers often do not have tolerance for incorrect replies impulsive children unduly suffer in the process of education and fail to realize their potential. According to Kagan (1965d) an impulsive child most likely goes through the following sequence while attempting to solve a problem: impulsive selection of an invalid solution-sequence results in failure which in turn causes anxiety and this anxiety gives rise to selection of a second sequence, resulting in failure again, and so the cycle continues. Such a history of failures results ultimately in the child's withdrawal from problem situations and he becomes apathetic or hostile towards intellectual tasks. If the line of reasoning provided above is valid then an empirical investigation of the school achievement of both impulsive and







reflective children is required.

### Integrative Complexity and Reflection-Impulsivity

Integrative complexity refers to the degree of differentiation, within the concepts, and integration among them. The higher the degree of differentiation and integration the more complex the person is. Sieber and Lanzetta (1964) found that conceptually complex people took longer and sought more information before making a decision as compared with conceptually simple (less complex) people.<sup>1</sup> Accordingly it seems plausible to expect a positive relation between a measure of "structural" complexity and reflection.

### Analytic Tendency and Reflection-Impulsivity

The mention of the reflection variable was first made by Kagan, Moss and Sigel (1963) while trying to explain theoretically an analytic attitude which they observed in a large number of children.

One of the possible antecedents of an analytic attitude is the ability to inhibit motor discharge; the ability to modulate behavior in the face of irrelevant stimulation that tempts reactivity; the ability to reflect in situations that elicit alternative response tendencies (p. 110).

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<sup>1</sup>Harvey (1966) found that conceptually complex subjects took significantly shorter time than conceptually simple subjects in solving the Denny Doodlebug Problem. Harvey (1967) describes two types of complexity: "content" and "structural". His measures are of "content" complexity whereas measures used by Sieber and Lanzetta are those of "structural" complexity.



It was the enquiry into the determinents of the preference for analytical conceptual groupings, where success depended on the ability to find similarities among the differentiated parts of the stimuli in a group, that led Kagan and his co-workers (1964) to postulate two fundamental cognitive dispositions: reflection over alternative solutions and analysis of visual arrays. Since analytic tendency is the mother variable, it was thought proper to include this variable in the network.

#### Sex and Reflection-Impulsivity

Maccoby (1966, p. 29) has reviewed several studies on relationships between impulse control (reflection) and the use of analytic concepts, adoption of a winning strategy, "coping" and intellectual interest for both sexes. She comes to the conclusion that "impulsiveness is a negative factor for at least some aspects of intellectual development in boys, but for girls it is less negative -- and perhaps even a positive -- factor." Lewis et al (1968) also believe that important sex differences exist in this area since they found that response latency and number of errors correlate significantly with different variables in the two groups. Kagan (1965a) reports different correlations for boys and girls between error scores and verbal ability. However, Ward (1968) found no sex effect on either error scores or response latency. Most of the correlations



reported in support of either position (sex differences or not) are generally low. However, it was considered that the matter merited further exploration.

### Socio-economic Status and Reflection-Impulsivity

Reference has already been made to the works of Shipman and Hess (1966) and Campbell (1968) to the effect that a significant relationship exists between socio-economic status and R-I.

### Summary of Predictions

The major predictions of the present study may be summarized as follows:

I. Reflective subjects will significantly differ from impulsive subjects on the variables in this study.

(a) The average scores of impulsive subjects will be significantly greater than the average scores of reflective subjects on the following variables:

- (1) Risk taking,
- (2) Impulsiveness,
- (3) Response agreement,
- (4) External locus of control,
- (5) Mental speed,
- (6) Extraversion,



- (7) Anxiety,
- (8) Neuroticism.

(b) The average scores of reflective subjects will be significantly greater than the average scores of impulsive subjects on the following variables:

- (9) Persistence,
- (10) School achievement,
- (11) Analytic tendency,
- (12) Integrative complexity,
- (13) Verbal ability.

II. Most of the variables will load on a common factor of "reflection".

Response latency, integrative complexity, persistence, verbal ability, analytic tendency and school achievement will load positively while number of errors and risk taking, impulsiveness, mental speed, extraversion, neuroticism, anxiety, locus of control, response agreement and socioeconomic status will load negatively on the same factor.

III. This is a minor exploratory prediction. It is predicted here that differences between high-latency, high error and low-latency, low error groups exist on the variables listed below.





Differences between these two groups and the two major groups of the study, reflective and impulsive groups are also predicted on the same variables:

- (1) Mental speed,
- (2) School achievement,
- (3) Verbal ability,
- (4) Persistence.



## CHAPTER II

### METHOD

#### Subjects

The sample for this study consisted of 217 grade ten students, from two Alberta high schools representing academic and non-academic programs. No attempt was made to make the sample representative of a predetermined population.

#### Tests

The tests are listed in Table I. Brief descriptions of the tests are given below. Details may be found in appropriate references.

#### Matching Familiar Figures

Out of the three measures of R-I, the Matching Familiar Figures (MFF) was used in this study. This measure has been most frequently used by Kagan (1965a) and other researchers (Lewis et al, 1968; Yando and Kagan, 1968) and appears to have higher reliability as compared with the other two measures, Haptic Visual matching and Design Recall Test (Kagan, 1965a). MFF consists of several similar problems. Each problem has a standard familiar figure and some variants of the standard. The subject is required to find the variant which is identical to the standard. This test has two versions: child and adult.



TABLE I  
TESTS USED IN THE STUDY

Variable	Test
1. Response Latency	R-I Matching Familiar Figures (Kagan)
2. Number of Errors	
3. Extraversion	Eysenck Personality Inventory
4. Risk Taking	Choice Dilemmas Procedure (Kogan and Wallach)
5. Locus of Control	I-E Scale (Rotter)
6. Response Agreement	Response Agreement Scale (Couch and Keniston)
7. Impulsiveness	Barratt Impulsiveness Scale
8. Anxiety	IPAT Anxiety Scale
9. Neuroticism	Eysenck Personality Inventory
10. Persistence	Nufferno Level Test
11. Mental Speed	Nufferno Speed Test
12. Verbal Ability	Lorge-Thorndike (verbal)
13. School Achievement	Grade IX (Department of Education) Scores
14. Cognitive Complexity	Interpersonal Topical Inventory (Tuckman)
15. Analytic Tendency	Conceptual Styles Test
16. Socio-economic Status	Blishen Scale
17. Sex	



The difference between the two versions is essentially in the number of variants, one of the variants being identical to the standard. The child version has six variants while the adult version has eight. As the sample consisted of high school students the adult version was used for greater dispersion. The test consisted of twelve items. The first two items were used for practice and the remaining ten were used to determine total response latency (decision time for the first responses) and total number of errors (errors made before finding the correct response). All 217 students were individually tested.

#### Eysenck Personality Inventory

The Eysenck Personality Inventory (EPI), which according to Lingo (1965) is a revision of the Maudsley Personality Inventory (MPI), is designed to measure extraversion and neuroticism -- the two most important sources of variance in personality questionnaires found by Eysenck in a number of factor analytic studies. The EPI, according to its authors (Eysenck and Eysenck, 1963) has some advantages over the MPI. The EPI is more understandable and has higher reliability.

#### Choice Dilemmas Procedure

Kogan and Wallach (1964) used seven different measures of decision making (risk taking) and related them to impulsiveness and a variety of other personality and





cognitive measures. The Choice Dilemmas Procedure was selected as a measure of risk taking in this study because this instrument has twelve items depicting a variety of lifelike situations with genuine risk taking properties.

#### Internal-External Control Test

The Internal-External scale (E-I) is a forced-choice type instrument in which the subject is forced to choose between an externally-worded and an internally-worded statement. The total number of externally-worded choices determines the subject's score. The scale has twenty-five items as given by Rotter (1966), three of which are filler items designed to obscure the purpose of the test.

#### Agreeing Response Set

Couch and Keniston (1960) developed the Agreeing Response Set scale (ARS). This is a relatively content-free measure of agreeing response set as a manifestation of individual personality. On the basis of their work with 200 volunteers, who were tested on a total of 681 items, an over-all agreement score was produced. Items that correlated .40 or higher with the total score have been put together in a short scale measure of the agreeing response tendency. In all there are fifteen items in the short scale which was used in this study. The subject is forced either to agree or disagree with each of the fifteen statements, with the number of agreements being his total score.



### Barratt Impulsiveness Scale

Barratt (1965) developed the Barratt Impulsiveness Scale (BIS), a self-report, forced-choice type measure. The scale has twenty-six items, fourteen keyed true and twelve keyed false. It has high correlations with other existing scales of impulsiveness found in Guilford-Zimmerman Temperament Survey (1949), 16 PF Scale (Cattell et al, 1957) and Thurstone Temperament Schedule (1953). The correlations range from .56 to .66. Accordingly, the BIS was considered a good representative of measures of impulsiveness. The BIS has been used by Messick and Fritsky (1963) and Kogan and Wallach (1964) as a measure of impulsiveness in studies of analytic attitude and risk taking behavior respectively.

### The IPAT Anxiety Scale Questionnaire

This is a brief, forty-item, objective questionnaire measuring general free anxiety level. According to Cohen (1965) "it is a mature fruit of a third of a century of both methodologically and clinically sophisticated large scale factor-analytic research" (p. 255). Reliability coefficients for the total anxiety score range from .80 to .93.

Evidence with respect to the validity of the test is satisfactory according to Cattell and Scheier (1963).



### Nufferno Level and Speed Tests

Both speed and level tests involve letter-series-type tasks in which the subject is required to find the next letter according to the rule inherent in the series. The level test contains seven cycles of increasing difficulty, each cycle consisting of five items of similar difficulty. Each cycle is scored separately. The maximum score is 700 indicating that every question of the seven cycles has been correctly answered. Usually subjects do not persist on the difficult cycles and scores reflect amount of persistence. Sufficient time was given to enable all the subjects to finish the test.

The speed test consists of twenty-one problems having the same level of difficulty. Three sections in the test provide sufficient practice for the actual test and for the procedure of encircling the last response on hearing a sound. On the actual test subjects were required to encircle the last response on hearing a tap on the board. The first tap was given after twenty seconds and the remaining ten taps were given after forty-second intervals. Average time for one correct response was calculated. Longer time for correct response indicates mental slowness.

The speed and level tests were administered consecutively in one session.



### The Lorge-Thorndike Intelligence Test (verbal)

According to Freeman (1959), Milholland (1959) and Pidgeon (1959), the Lorge-Thorndike Intelligence Tests is one of the best group tests available. These authors commend this test for its clarity and statement of objectives. Reliabilities are considered very satisfactory. The following comment by Freeman sums up the assessment of this test:

On the whole, Lorge-Thorndike series is among the sounder group instruments available, from the point of view of psychological insights (with regard to both content and concepts of intelligence) shown in selecting and developing the materials, and from the point of view of statistical analysis of the standardization data (p. 481).

Verbal form (Level 5) was used in this study as a measure of verbal ability.

### The Interpersonal Topical Inventory

The Interpersonal Topical Inventory (ITI) is a forced-choice measure of integrative complexity devised by Tuckman (1966). As compared with other measures of this variable (e.g., The This I Believe Test, The Schroder Paragraph Completion Test and the Sentence Completion Test), the ITI is more objective and easier to score. There are six items such as: (1) When I am criticized, (2) When I am in doubt. Each item has six pairs of statements and the subject is required to choose the one from each pair which is best representative of his feelings. Each statement





belongs to one of the four systems I-IV, the four nodal points on simplicity-complexity continuum. The subjects are required to show their preference for a statement belonging to one system over another of another system. Four raw scores determined by the number of statements chosen belonging to the four systems are derived. According to Tuckman's procedure of classification, the raw scores are converted into deciles (using college freshman norms). The highest decile determines the system to which a subject belongs, provided he does not score in the same decile for another system. The limitation of this classification procedure is that subjects scoring equally high in more than one systems cannot be classified. Tuckman (1966, p. 381) states "that the objective ITI is a potential substitute for the projective Sentence Completion test in large scale surveying of individuals for research."

#### Conceptual Styles Test

Kagan, Moss and Sigel (1963) developed a Conceptual Styles Test (CST). This is essentially a classification task where subjects are required to choose from three given pictures, two that go together in some way. Reason for their choice is also required. Similarity among the differentiated parts of the total stimuli was the criterion for including concepts in the analytical category while any other criterion, e.g., functional relationship resulted in



the concept being included in the non-analytical category. For example if two pictures, one of a dog and the other of a boy, both with an ear missing, were classified together. The subject, who states missing ear as his reason, is making use of the analytical category whereas another, who says that dog belongs to the boy, is being non-analytic.

#### School Achievement - Grade IX Departmental Examination

As the sample consisted of high school students (Grade X) and as Grade X students follow many different academic and non-academic patterns, it became difficult to assess their current status in school achievement which would be comparable over the whole sample. Curriculum and teacher differences were likely to contaminate (confound) the achievement variable. As a result, it was decided to use their achievement scores from the Grade IX final examination (which take principal-teacher ratings into consideration also) as the index of school achievement. At the time of the study all students in Alberta took the Grade IX Departmental Examinations.

#### The Blishen Scale

This scale is a measure of socio-economic status and is based on two criteria: income and education. It is a revised and updated version of the 1951 Blishen Scale (Blishen, 1967). The scale has high correlations with another similar scale (Pineo-Porter) and its earlier version.



### Procedure

As an introduction to the research project the subjects were told that the tests they were going to take constitute part of an attempt "to determine relationships between abilities and how people feel and act."

Two examiners, one male and the other female, administered the MFF individually to one half of the subjects of each sex. All the other tests were administered in groups of approximately twenty-five under the supervision of teachers or the writer. To ensure uniformity, instructions for the Lorge-Thorndike (verbal) were given by the writer in both schools through the intercom system and Nufferno speed and level tests were administered along with BIS by the writer to all the groups in one of the sessions.

### Testing Schedule

Four consecutive weeks were required to complete the administration of the MFF individually to all the subjects. Average time per student was approximately fifteen minutes. Three sessions, each consisting of eighty minutes, were required to administer the group tests. The tests were given in the order shown in Table II. All groups of subjects took the three sets of tests on three different days. Of the total 217 subjects involved in the project, 173 took all the tests.



TABLE II  
TEST ORDER

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Session I

Large-Thorndike (verbal)  
Eysenck Personality Inventory  
Choice Dilemmas Procedure

Session II

Internal-External Inventory  
Response-Agreement Scale  
Individual Topical Inventory  
IPAT Anxiety Questionnaire Scale  
Conceptual Styles Test

Session III

Nufferno Speed Test  
Nufferno Level Test  
Barratt Impulsiveness Scale

---

Scoring and Analysis

Each of the tests was hand scored and checked by two independent scorers. Most of the tests presented no scoring problems as scoring directions were straightforward and easy to follow. In some cases, however, either the scoring directions were complicated or they had to be modified to prevent loss through attrition.

While scoring the speed test the objective was to





find the average number of seconds the subject took to answer an item correctly. Subjects showed, by encircling the last response in each forty second interval, how many items they completed in a section. Since interest was centered on the correct speed, only those sections which were either totally correct or mostly correct were taken into account while calculating the average time spent on a single item. Higher scores indicate lower mental speed.

Scoring of the level test was relatively easy. The total of thirty-five items is divided into seven cycles of five items each. Each level was scored separately. The score at each level was determined by the percentage of correct responses. Percentages of all the five levels were then added together to get the final score.

The ITI was scored according to Tuckman's instructions and the subjects were assigned to systems I, II, III, or IV, according to the pattern of their choices. This procedure left about forty subjects unclassified. In order to retain all the 173 subjects for factor analyses, it was decided to classify these subjects in a way that would be comparable to the rest of the sample. On the assumption that systems I-IV are equidistant nodal points, on a continuum, it was decided to assign midpoint scores between the two systems on which they had scored in the same decile. So a subject scoring equally high on systems II and III got a score of 2.5. In this manner we were able to assign complexity scores to all



the 173 subjects.

Scores of choice Dilemmas Procedure represent the chances of success a subject would like to have before he recommends the operation to somebody close to him. If the subject did not recommend the operation no matter what his chances of success were his score was maximized. A high score indicates low risk taking.

Conceptual Styles Test (brief version) has nineteen items in all and each item was scored one (analytic) or zero (non-analytic) depending upon whether the subject took part of the stimuli into consideration while putting the two stimuli together.

#### Analysis of Data

Out of the total sample of 217 students, 173 took all the tests. Analysis of variance and factor analysis were used to test the predictions given above. For the analysis of variance the total sample of 217 was divided into four groups on the basis of scores on response latency and number of errors. The median for number of errors lay between 6 and 7, identifying those making 7 or more errors as high-error subjects and those making 6 or less as low-error subjects. The median latency in seconds was 523 and this number determined the categorization of high and low-latency subjects. The 2 x 2 contingency table (Table III) shows the number of subjects in each cell.



TABLE III  
2 X 2 CONTINGENCY TABLE

Response Latency	Number of Errors		
	High	Low	Total
High	33	74	107
Low	75	35	110
Total	108	109	217

One-way analysis of variance was done to find whether differences existed among high-error, high-latency; high-error, low-latency (impulsive); low-error-high latency (reflective) and low-error low-latency groups on some of the variables. If these differences were found to be significant beyond .05 level then Scheffé multiple comparisons between means were made to find which two groups differed significantly from each other. This analysis provided tests for Predictions I and III.

In order to test for Prediction II, involving a common factor of reflection-impulsivity, replication was incorporated in the design. Yarrow, Campbell and Burton (1968) make a strong plea for the need of replication in behavioral sciences. These authors believe that only highly consistent findings in replicated studies authorize a researcher to theorize about his findings (Yarrow, Campbell, Burton, 1968):



If, on the other hand, he has performed a nearly exact repetition of his procedures and outcome spells inconsistency, there is little justification for taking his findings seriously or for theorizing about them. There is more work to be done on procedures or theory or both. By replication of this kind, at this stage, he has spared himself the disaster of using an unverified finding as the basis for a next theoretical step when, indeed, the first step is nonexistent (pp. 9-10).

Factor analysis involved 173 subjects who took all the tests. There were 88 girls and 85 boys in this group. These two parts were randomly split into equal halves, resulting in two groups of 44 girls each and two groups of 42 and 43 boys respectively. In a random fashion each group of boys was combined with one of the groups of girls that resulted in two random subsamples with almost equal members, (86 and 87) and equal sex representation. Principal component analysis was done on the two subsamples separately. In both cases factors with eigenvalues greater than unity were extracted. The two correlation matrices were rotated orthogonally according to varimax criteria. The most meaningful set (in terms of a "reflection" factor) of factors in either of the two studies was accepted as target and the factor matrix from the other subsample was re-rotated by the Kaiser method for maximum overlap with the target matrix. Only consistent correlations and factor loadings in the two analyses were interpreted. Several factor loadings and correlations of .30 or above were ignored if they appeared only in one analysis.





## CHAPTER III

### RESULTS

In addition to the variables described in Chapter I, six achievement subscores (reading, language, literature, social studies, mathematics and science) and four component scores of integrative complexity, rather than a single composite score, based on the number of statements belonging to each of the four systems, were included in the analysis. This resulted in a total of twenty-three variables on which differences between reflective and impulsive Ss were computed. Table IV shows the means and standard deviations for reflective and impulsive groups. Significant differences were found in the hypothesized direction on the following variables (Table IV):

- (1) Verbal ability,
- (2) Persistence,
- (3) Reading, language, mathematics, science and total achievement.

Differences on literature, social studies and socio-economic status were found in the predicted direction but they did not reach significance (Table IV). Accordingly, only partial support was found for Prediction I.

Tables V and VI provide the intercorrelations among the seventeen variables, as described in Chapter I, for group I (N=87) and group II (N=86), involving all the



TABLE IV

MEANS, STANDARD DEVIATIONS AND SIGNIFICANCE OF DIFFERENCES BETWEEN IMPULSIVE (N=75)  
AND REFLECTIVE (N=74) GROUPS

Measure	Impulsive Group		Reflective Group		t
	Mean	S.D.	Mean	S.D.	
1. Verbal Ability*	47.01	16.47	54.09	14.45	-2.79*
2. Extraversion	14.14	5.70	13.43	5.70	.77
3. Neuroticism	12.92	6.14	12.35	5.73	.58
4. I-E (Locus of Control)	9.63	4.44	9.61	3.87	.03
5. Anxiety	32.23	16.91	32.96	15.31	.28
6. ARS	7.91	3.41	7.62	3.11	.53
7. Impulsiveness	15.05	5.49	14.42	5.26	.72
8. Analytic Tendency	12.04	6.07	12.15	5.52	-.11
9. System I Statements	8.04	2.91	7.78	3.31	.50
10. System II Statements	8.41	2.91	8.14	3.47	.53
11. System III Statements	8.33	3.02	8.26	3.26	.15
12. System IV Statements	9.27	2.99	8.90	3.29	.70
13. Correct Response Time <sup>1</sup>	11.61	5.33	12.41	6.19	.85
14. Persistence*	212.96	93.03	263.36	106.54	-3.08*
15. Caution <sup>2</sup>	72.00	17.93	71.01	19.61	.32
16. Reading*	4.64	2.01	5.43	1.94	-2.45*
17. Language*	4.52	1.56	5.27	2.03	-2.53*
18. Literature	4.79	1.87	5.30	2.03	-1.60
19. Social Studies	4.81	1.52	5.14	1.99	-1.11
20. Mathematics*	4.47	1.73	5.34	1.97	-2.87*
21. Science*	4.56	1.73	5.20	1.94	-2.13*
22. Total Achievement*	27.79	8.49	31.72	10.26	-2.55*
23. Socio-economic Status	41.59	11.27	43.99	13.35	-1.19

1. Mental speed.

2. Risk taking.

\*- Significant differences at .05 level.



TABLE V  
INTERCORRELATIONS BETWEEN SEVENTEEN VARIABLES FOR GROUP\* I  
(N=87)

Variable #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	--	-27	10	00	06	28	18	-16	08	13	05	-21	21	01	04	-14	21
2		--	-44	09	02	-01	02	08	-01	-05	08	24	10	02	15	01	-21
3			--	-31	-06	03	04	06	05	02	-07	08	-51	-15	-34	-08	16
4				--	-16	-01	-00	-26	-12	-24	-12	01	45	-10	76	12	13
5					--	-27	-37	03	00	42	12	-09	-16	-19	-16	-11	-21
6						--	83	20	46	05	-09	-02	-04	14	-07	08	02
7							--	21	44	-01	-05	02	00	13	-04	13	03
8								--	17	24	00	-04	-34	30	-26	09	05
9									--	37	05	-03	-05	-08	-08	05	-11
10										--	13	05	-24	-25	-26	-02	-04
11											--	-03	-10	-16	-08	10	-06
121												--	-11	-22	20	27	01
13													--	04	53	03	02
142														--	-11	09	-08
15															--	30	10
16																--	01
17																	--

#	1. Sex	6. Neuroticism	11. Analysis	15. Achievement
2. MFF Latency	7. Anxiety	12. Correct Response	16. SES	
3. MFF Errors	8. Locus of Control	Time	17. Complexity	
4. L-T (verbal)	9. ARS	13. Persistence		
5. Extraversion	10. Impulsiveness	14. Caution		

1. Mental speed.

2. Risk taking.

\*- Decimals have been omitted.



TABLE VI  
INTERCORRELATIONS BETWEEN SEVENTEEN VARIABLES GROUP\* II  
(N=86)

Variable #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	--																
2	-21	--															
3	03	-55	--														
4	-02	24	-17	--													
5	13	-19	13	-04	--												
6	38	-10	00	-29	19	--											
7	29	-07	-03	-21	-08	74	--										
8	11	-11	-03	-18	18	-06	07	--									
9	15	-19	21	-47	16	41	29	13	--								
10	13	-26	09	-29	48	35	33	28	30	--							
11	08	-20	-01	-10	12	16	21	00	07	18	--						
12	-08	-03	-12	-08	-11	03	01	04	14	-09	-03	--					
13	02	27	-40	37	-17	-08	-06	00	-26	-23	06	13	--				
14	-02	-15	-03	07	04	08	09	-15	-12	-09	-01	07	07	--			
15	-03	18	-37	57	-14	-20	-26	-06	-30	-39	-17	28	66	08	--		
16	-13	11	-20	02	03	18	20	12	03	14	08	02	22	07	21	--	
17	05	-04	-08	-10	15	08	-05	03	06	07	17	01	01	12	03	20	--

#1. Sex  
2. MFF Latency  
3. MFF Errors  
4. L-T (verbal)  
5. Extraversion  
6. Neuroticism  
7. Anxiety  
8. Locus of Control  
9. ARS  
10. Impulsiveness  
11. Analysis  
12. Correct Response  
13. Persistence  
14. Caution  
15. Achievement  
16. SES  
17. Complexity

1. Mental speed.

2. Risk taking.

\*- Decimals have been omitted.





individuals for whom complete profiles were available. For the purpose of the factor analysis a single complexity score was determined as already described. The six subscores of achievement were dropped. These procedures were adopted to minimize the influence of these two sets of similar variables on factors. Inclusion of sex, response latency and number of errors brought the total to the original seventeen variables (Table I).

As response latency and number of errors are the determining variables for prediction II, concerning a strong common reflection-impulsivity factor, their relationships with other variables are shown in Table VII for both groups. Response latency and number of errors have high consistent correlations with each other ( $-.44$  and  $-.55$ ).

Varimax factor rotations of six factors with eigenvalues greater than unity are presented in Tables VIII and IX. The rotated factor matrix for group II gave a more interpretable factor of reflection-impulsivity (Factor III). Response latency and number of errors loaded heavily on this factor. In terms of the criteria of high loadings of both response latency and number of errors on a common factor (R-I Factor), Factor III (Table IX) with loadings of  $.811$  and  $-.709$  of these two variables was considered more meaningful than Factor V in the factor matrix for group I with loadings of  $-.676$  and  $.487$  of these variables respectively (Table VIII). Factor V in the factor matrix



TABLE VII

CORRELATIONS BETWEEN RESPONSE LATENCY AND NUMBER OF  
 ERRORS AND THE OTHER FIFTEEN VARIABLES FOR BOTH  
 GROUPS\*

Variable	Response Latency		No. of Errors	
	Group I	Group II	Group I	Group II
1. Sex	-27	-21	10	03
2. MFF Latency	--	--	-44	-55
3. MFF Errors	-44	-55	--	--
4. Verbal Ability	09	24	-31	-17
5. Extraversion	02	-19	06	13
6. Anxiety	02	-07	04	-03
7. Locus of Control	08	-11	06	-03
8. ARS	-01	-19	06	21
9. Impulsiveness	-05	-26	02	10
10. Analysis	08	-20	-07	-01
11. Correct Response Time <sup>1</sup>	24	-03	-08	-12
12. Persistence	10	27	-51	-40
13. Caution <sup>2</sup>	02	-15	-15	-03
14. Achievement	15	18	-34	-37
15. Neuroticism	-01	-10	03	00
16. Socio-economic Status	01	11	-08	-20
17. Complexity	-21	-04	16	-08

1. Mental speed

2. Risk taking

\*- Decimals have been omitted.



TABLE VIII  
VARIMAX FACTOR MATRIX FOR GROUP I  
(N=86)

Variable	Factors						
	I	II	III	IV	V	VI	$h^2$
1. Sex	213	316	184	492	466	-149	660
2. MFF Latency	225	-005	057	242	-676	171	599
3. MFF Errors	-658	025	-122	008	487	-252	749
4. L-T (verbal)	770	-047	-152	146	110	-122	666
5. Extraversion	-149	-282	686	-205	-123	-126	645
6. Neuroticism	-016	902	-135	-019	056	112	848
7. Anxiety	-004	886	-210	074	033	130	853
8. Locus of Control	-296	168	208	176	040	778	796
9. ARS	-088	716	310	008	-106	-077	634
10. Impulsiveness	-205	200	799	014	030	-012	722
11. Analysis	015	-045	471	073	-023	042	232
12. Correct Response Time <sup>1</sup>	-021	017	-031	726	-172	-221	608
13. Persistence	799	019	-120	-252	-080	-095	731
14. Caution <sup>2</sup>	002	032	035	-331	-121	702	744
15. Achievement	819	-051	-109	297	073	-143	799
16. SES	203	103	086	664	132	133	535
17. Complexity	130	-055	-059	144	761	155	647
Sum of squares	2.65	2.38	1.77	1.66	1.61	1.40	11.47

1. Mental speed.

2. Risk taking.

\*- Decimals have been omitted.



TABLE IX  
VARIMAX FACTOR MATRIX FOR GROUP\* II  
(N=86)

Variable	Factors						h <sup>2</sup>
	I	II	III	IV	V	VI	
1. Sex	262	634	-331	212	-164	-110	664
2. MFF Latency	135	-103	811	-116	-177	-135	750
3. MFF Errors	-352	-076	-709	-017	-095	-058	645
4. L-T (verbal)	760	-155	037	-128	-084	-260	694
5. Extraversion	001	-002	-299	611	341	-251	642
6. Neuroticism	-180	851	028	083	175	060	799
7. Anxiety	-212	864	139	-072	083	018	823
8. Locus of Control	-027	033	046	729	-056	196	578
9. ARS	-507	350	-098	244	001	366	583
10. Impulsiveness	-324	300	-076	594	256	-168	647
11. Analysis	-061	222	-070	022	467	-157	301
12. Correct Response Time <sup>1</sup>	083	-012	-025	-023	005	856	741
13. Persistence	718	061	317	-018	082	192	663
14. Caution <sup>2</sup>	176	100	-269	-442	483	095	551
15. Achievement	827	-142	157	-038	017	338	845
16. SES	078	108	442	146	523	144	528
17. Complexity	-018	-097	019	084	691	059	497
Sum of squares	2.48	2.23	1.80	1.63	1.51	1.31	10.95

1. Mental speed.

2. Risk taking.

\*- Decimals have been omitted.





for group II was the most meaningful in terms of the above mentioned criteria. As replication was emphasized in this study and as interest was centered on the consistency of loadings on the same factor for the two groups, factor matrix for group I was rotated by the Kaiser method for maximum overlap with the factor matrix for group II. The resulting new factor matrix for group I is presented in Table X. Cosines of angles of rotation between the factor matrices (Tables VIII and X) are given in Table XI. In this matrix response latency loaded .753 and number of errors -.708 on Factor III. This new factor matrix was another orthogonal rotation of the matrix for group I. An additional criterion used for interpretation of factors was the consistency with which different variables loaded on the corresponding factors in the two factor matrices for the two groups (Tables IX and X). Moderate to high loadings that were not replicated were ignored. Factors I - VI have been assumed to represent the same hypothetical variables in both factor matrices (Tables IX and X).

### Interpretation of Factors

Factor interpretation is based on the consistency between the loadings of the same variables on the same factors in the two groups (Tables IX and X).

Factor I: Achievement-Persistence. Those variables which loaded on this factor, in order of their loadings in



TABLE X

KAISER ROTATION OF FACTOR MATRIX FOR GROUP I FOR MAXIMUM  
OVERLAP WITH FACTOR MATRIX FOR GROUP II

Variable	Factors					
	I	II	III	IV	V	VI
1. Sex	320	502	-468	155	044	-248
2. MFF Latency	-009	-091	753	030	-148	-000
3. MFF Errors	-438	-044	-708	-041	-009	227
4. I-T (verbal)	768	023	163	-088	038	201
5. Extraversion	-101	-235	-055	630	-132	-402
6. Neuroticism	-173	864	064	-119	048	227
7. Anxiety	-173	822	117	-180	064	311
8. Locus of Control	-495	124	261	079	675	-083
9. ARS	-223	654	110	337	-132	119
10. Impulsiveness	-249	175	-027	781	068	-121
11. Analysis	-019	-050	088	454	092	-082
12. Correct Response Time1	-072	-217	272	137	-124	668
13. Persistence	766	184	212	-141	-123	-179
14. Caution2	-149	146	249	-549	392	-428
15. Achievement	796	-020	251	-018	042	318
16. SES	111	-035	247	185	336	560
17. Complexity	261	005	-450	-027	568	230

1. Mental speed.

2. Risk taking.

Decimals have been omitted.



TABLE XI  
COSINES OF ANGLES OF ROTATION

Factor Matrix 2 (Table X)	Factor Matrix 1 (Table VIII)					
	I	II	III	IV	V	VI
I	917*	335	097	000	-101	163
II	232	-810	535	-025	018	054
III	050	047	113	916	243	-292
IV	-261	293	478	108	252	737
V	182	-293	-579	006	662	329
VI	033	240	358	-387	655	-484

\* All decimals omitted.

group I, are:

<u>Variable</u>	<u>Group I</u>	<u>Group II</u>
Achievement	.80	.83
Verbal Ability	.77	.76
Persistence	.77	.72
MFF Errors	-.44	-.35
Sex	.32	.26
Agreeing Response Set	-.22	-.51

The very high loadings of achievement, verbal ability and persistence are the keys to interpreting this factor. Although sex and agreeing response set also load on this factor, consistently moderate loadings of MFF errors are of special interest in that achievement-persistence has



greater common variance with MFF errors than with response latency that failed to load on this factor.

Factor II: Anxiety. This factor is marked by the following variables:

<u>Variable</u>	<u>Group I</u>	<u>Group II</u>
Anxiety	.86	.85
Neuroticism	.82	.86
Agreeing Response Set	.65	.35
Sex	.50	.63

High loadings of anxiety and neuroticism and moderate loadings of agreeing response set determined the name of this factor. Sex loaded higher on this factor than on any other. Eysenck and Eysenck (1968) report correlations of .70 between their neuroticism scale and Cattell's anxiety scale. Cattell and Scheier (1963) report that high school girls score 9.3 per cent higher on their anxiety scale than the boys on the average. These findings are in agreement with our interpretation of this factor. Response agreement also loads higher on this factor than on any other.

Factor III: Reflection. This factor was identified by high positive loadings of response latency and high negative loadings of number of errors.





<u>Variable</u>	<u>Group I</u>	<u>Group II</u>
Response Latency	.75	.81
Number of Errors	-.71	-.71
Sex	-.47	-.33
Socio-economic Status	.25	.44
Achievement	.25	.16
Persistence	.21	.31

This is the key factor for prediction II. Of all the seventeen variables, only sex, socio-economic status, achievement and persistence load on this factor besides response latency and number of errors.

Factor IV: Impulsiveness. This factor is identified by the following variables:

<u>Variable</u>	<u>Group I</u>	<u>Group II</u>
Impulsiveness	.78	.59
Extraversion	.63	.61
Risk Taking	.55	.44
Response Agreement	.34	.24

Impulsiveness seems to be the common element in these four personality variables measured by paper and pencil tests. This separate factor of impulsiveness determined by these four variables has none of the variables common with reflection factor (Factor III).



Factor V: Integrative Complexity. This factor is marked by the following three variables:

<u>Variable</u>	<u>Group I</u>	<u>Group II</u>
Integrative Complexity	.57	.69
Socio-economic Status	.34	.52
Risk Taking	-.39	-.48

All three variables have higher loadings on this factor than they have on any other.

Factor VI: Incorrect Speed. The following variables loaded on this factor:

<u>Variable</u>	<u>Group I</u>	<u>Group II</u>
Mental Speed	.67	.86
Extraversion	.40	.25
Achievement	-.32	-.34

The negative loadings of achievement suggest that this speed is not conducive to performance on school oriented tasks.

### Analysis of Variance

One-way analyses of variance were performed to test prediction III regarding differences among the four groups (page 32) on the following variables:

- (1) Verbal Ability,
- (2) Persistence,
- (3) Mental Speed,



## (4) Achievement.

A chi square test for homogeneity of variance was performed on the variances obtained for each of the above listed variables. Results of this test are given in Table XII. Only in the case of mental speed was the null hypothesis rejected ( $=.05$ ). F ratios and p values are presented in Table XIII. As the F ratios for verbal ability, persistence and achievement are significant beyond .05 level, differences between individual pairs of means were tested for each of these three variables.

Probability matrices for Scheffé multiple comparisons of means on verbal ability, persistence and achievement are presented in Tables XIV, XV, and XVI. Significant differences were found between high-latency, low-error (reflective) and low-latency, high-error (impulsive) groups beyond .05 level only in persistence.

TABLE XII  
HOMOGENEITY OF VARIANCE TESTS  
(Latency-Error Classification)

Variable	df (k-1)	Chi square	P
1. Verbal Ability	3	2.10	.55
2. Persistence	3	6.67	.08
3. Total Achievement	3	3.12	.37
4. Mental Speed	3	9.65	.02



TABLE XIII  
SUMMARY OF ANALYSIS OF VARIANCE  
(Latency-Error Classification)

Variable	Source	S.S.	M.S.	df	F	P
1. Verbal Ability	GROUPS	2823.63	941.21	3	3.83	.010
	ERROR	52324.13	245.65	213		
2. Persistence	GROUPS	118890.00	39630.00	3	3.68	.013
	ERROR	2294784.00	10773.63	213		
3. Achievement	GROUPS	1190.31	396.77	3	4.48	.004
	ERROR	1887.82	88.63	213		
4. Mental Speed	GROUPS	374272.00	124757.31	3	0.35	.79
	ERROR	76733696.00	360252.06	213		

TABLE XIV

PROBABILITY MATRIX FOR SCHEFFE MULTIPLE COMPARISON OF MEANS: LATENCY-RESPONSE CLASSIFICATION-VERBAL ABILITY

	Verbal Ability			
	I	II	III	IV
I	1.000	.0579	.1711	.9998
II		1.000	1.000	.1721
III			1.000	.2765
IV				1.000





TABLE XV

PROBABILITY MATRIX FOR SCHEFFE MULTIPLE COMPARISON OF  
MEANS: LATENCY-RESPONSE CLASSIFICATION-PERSISTENCE

	Persistence			
	I	II	III	IV
I	1.000	.0347	.9997	.9815
II		1.000	.1102	.3084
III			1.000	.9776
IV				1.000

TABLE XVI

PROBABILITY MATRIX FOR SCHEFFE MULTIPLE COMPARISON OF  
MEANS: LATENCY-RESPONSE CLASSIFICATION-ACHIEVEMENT

	Achievement			
	I	II	III	IV
I	1.000	.0934	.0776	.9729
II		1.000	.9504	.1102
III			1.000	.0777
IV				1.000



## CHAPTER IV

### DISCUSSION

The first of the present findings to be discussed concerns Prediction I. Reflective Ss, as predicted, did have significantly higher verbal ability, showed significantly better persistence and performed significantly better in school subjects as compared with impulsive Ss. The present finding of significant differences between the two groups in school achievement contradicts an earlier finding (Campbell, 1968). The present findings lent partial support to Prediction I, concerning the differences between reflective and impulsive Ss in terms of the variables included in this study. The results with respect to verbal ability and persistence are in agreement with the results reported by Kagan (1965a). Kagan compared the total time spent by reflective and impulsive Ss with hard tasks and found that the differences were significant beyond the .01 level. He also reports a median correlation of  $-.28$  between MFF errors and WISC verbal skills. Meichenbaum and Goodman (1969) found significant differences between reflective and impulsive Ss on all subtests of the Thurstone Primary Mental Abilities test for K-1 (revised form, 1962). The four subtests are: verbal meaning, perceptual speed, number facility and spatial relations. In the present study differences between reflective and impulsive Ss in language,



reading, mathematics and science were found to be significant but differences in social studies and literature although in the predicted direction failed to reach significance (The level of significance = .05).

Postulating that impulsive and reflective approaches will have differential facilitating effect on the performance of students in different subject areas, Kagan (1966c) writes:

Some of the academic contents children must master require reflection and analysis, for instance, mathematics and physical sciences. But maximal productiveness and mastery of principles in aspects of the arts, social studies and humanities may be hampered by an excessively reflective orientation. New pedagogical procedures should acknowledge this interaction between the preferred strategies of the learner and the material to be acquired and tailor the presentation of the material to the psychological requirements of the task and the cognitive predisposition of the learner (p. 522).

No support was found for Kagan's view of differential facilitating effect of the two approaches (impulsive and reflective) on different academic contents. There was no evidence of any superiority of impulsive Ss over reflective Ss in social studies, or any other subject. In another study, however, Kagan, Pearson and Welch (1966a), on the basis of their finding that impulsive children make more errors in problems involving inductive reasoning, remark:

These findings have a potential implication for the teacher or tutor. Arithmetic, social studies and science all require inferences from the child (p. 594).



The present findings of absence of superiority of impulsive Ss over reflective Ss in any subject area are better explained by the above quote. Social studies also involves the drawing of inferences and reflective Ss, who have an advantage in this respect, are likely to perform better than impulsive Ss in this subject too.

The major lack of support for this prediction came from variables in the personality area. No differences were found on any of the eleven variables between reflective and impulsive groups.

Significant differences in verbal ability called into question Kagan's view (1966c) that reflection-impulsivity was relatively independent of verbal ability. On the basis of significant differences found between reflective and impulsive children on the Thurstone Primary Mental Abilities Test, Meichenbaum and Goodman state:

From the present study it is not clear to what degree conceptual tempo contributes to differences on the PMA test. An interesting experiment designed to assess this would be to select a group of impulsives and reflectives on the basis of the MFF test who do not differ on intelligence measures such as the Binet or WISC and then to examine their performance on such measures as the PMA test, Peabody Picture Vocabulary test or Raven's Matrices test (pp. 793-794).

Likewise in this study it is difficult to say how much contribution R-I makes to the differences in school achievement unless verbal or total intelligence are controlled. Witkin (1963), however, does not think such a





procedure appropriate.

Finally, with regard to IQ, I feel that cognitive styles are represented in performance on standard intelligence tests, and so "controlling for IQ" is not an appropriate issue in studies of cognitive styles (p. 122).

The next results to be discussed are the factor analytic findings of all the seventeen variables including response latency and number of errors (Prediction II). Correlations between MFF latency and MFF errors for the two groups were  $-.44$  and  $-.55$ , which are consistent with the range of negative correlations reported by Kagan (1965a) and other researchers (Brady, 1969; Stewin, 1969, and Meichenbaum and Goodman, 1969).

The first principal axis factors in the two unrotated factor matrices were examined in terms of the loadings of MFF latency and MFF errors if they could be interpreted as R-I factors. Since these two variables failed to load most heavily on the first principal axis factors it was decided to rotate the factors according to varimax criteria for more meaningful interpretation.

On the basis of high positive loadings of MFF latency and high negative loadings of MFF errors a reflection factor (Factor III) was identified in both the groups (randomly determined). According to Prediction II, most of the variables were expected to load on this factor. Very little support was found for this hypothesis. Besides MFF latency and MFF errors, sex, SES, achievement and persistence



loaded, mostly low, on the reflection factor. Other variables either failed to load on this factor or loadings were not consistent in the two groups. These results are mostly in agreement with the findings of mean differences reported under Prediction I. Boys display more reflection than girls. SES and persistence are related to reflection. Association between R-I and SES is consistent with Campbell's findings (1968). Results from a series of t tests and factor analyses indicate that R-I has few links with personality variables employed in this study. Associations of R-I with the variables that loaded on the reflection factor are also small. Most of the variables loaded on other, rather strong factors which were in fact totally independent of the key factor of reflection. The other five factors identified in this study were: Achievement-persistence, Anxiety, Impulsiveness, Integrative complexity, and Incorrect speed.

Moderate loadings of number of errors on achievement-persistence factor (Factor I) and failure of response latency to load on this factor suggest that achieving-persisting subjects tend to make fewer errors but they do not take longer time. The major index of R-I, response latency, is less associated with achievement than the minor index, number of errors. Emergence of strong independent factors of reflection and achievement-persistence suggests that mere reflection, without persistence, has little



relationship with achievement.

Similarly appearance of a strong anxiety factor (Factor II) that is independent of the reflection factor suggests that the measures of anxiety and R-I are not related to each other. This is in agreement with an earlier finding reported by Ward (1968). Ward's sample consisted of kindergarten children (mean age 68.9 months) and he pointed out the incorrectness of the hypothesis put forward by Kagan et al (1964) that anxiety of an impulsive child over the possibility of failure results in quick and careless responses. Since measures of anxiety and neuroticism employed in this study are measures of general anxiety, it can be argued that such measures are not valid indices of anxiety over failure. Kagan (1966b) deplores the lack of appropriate measures of the construct of anxiety over failure. This hypothesis, then, will have to remain untested until valid measures are available.

The lack of relationship between the two measures of impulsiveness (BIS and MFF) calls for some discussion. No differences were found between reflective and impulsive Ss on impulsiveness as measured by the BIS. The impulsive-ness factor (Factor IV) was represented by impulsiveness (BIS), extraversion, risk taking and agreeing response set. None of the variables loading on the impulsiveness factor loaded on the reflection factor. The fact that these two



factors are orthogonal to each other allows the conclusion that R-I is not associated with any of the variables loading on the impulsiveness factor. One way to explain this finding is to point out that impulsiveness as measured by the BIS is more related to motor delay than to cognitive delay (Barratt, 1967). Loadings of impulsiveness (Barratt, 1965), extraversion (Eysenck and Eysenck, 1963) and agreeing response set (Couch and Keniston, 1960) on a common factor are consistent with the descriptions of these variables presented by these authors. Relationship between impulsiveness and risk taking found in this study is similar to the one reported by Kogan and Wallach (1964). Choice Dilemmas as a measure of risk taking has no task similarity with the other three, much similar measures, loading on the same factor of impulsiveness.

Lack of relationship between integrative complexity as measured by the ITI and reflection-impulsivity is consistent with an earlier finding (Stewin, 1969). Loadings of integrative complexity, risk taking and socio-economic status on the same factor (Factor V) seem to fit the theory presented by Schroder, Driver and Streufert (1967). As measures of school achievement employed in this study were objective type tests, lack of relationship between achievement and integrative complexity supports Claunck's findings (1964). Claunck found that complexity of personality structure was unrelated to scores based on objective







questions but on essay questions abstract subjects (more complex) did significantly better than concrete subjects (simple).

Failure of analysis to load on the reflection factor or lack of differences between reflective and impulsive groups on this variable is hard to explain. Kagan et al (1964) postulated R-I on the basis of their work on analysis and found that analytic children tended to be reflective. It is quite possible that it is only in younger children that a relationship between R-I and analysis exists but as they grow to be sixteen years old the relationship disappears. Another reason could be the inappropriateness of the test as a measure of analysis for grade X students. The Conceptual Styles Test as a measure of analysis has been mostly used with younger children.

Locus of control did not load consistently on the same factor in the two groups. This may be due to the fact that the test is psychometrically underdeveloped. In one group it loaded .73 on the impulsiveness factor while in the other group it loaded .68 on the complexity factor. This inconsistency made it hard for any meaningful interpretation. No other evidence of any relationship between R-I and locus of control exists. A factor of incorrect speed (Factor VI) was identified. This factor was represented by high loadings of mental speed and low



loadings of extraversion and achievement. The fact that mental speed and achievement loaded in opposite direction suggests that this is a kind of speed which is not conducive to achievement. Extraversion implies such a speed. Accordingly it would be reasonable to expect that some measures of impulsiveness should have loaded on this factor.

Agreeing response set loaded negatively on achievement-persistence factor and positively on anxiety and impulsiveness factors. These relationships support the theory put forward by Couch and Keniston (1960). Naysayers tend to be better achieving and persisting while yeasayers seem to be more impulsive and anxious.

The last set of findings to be discussed relates to Prediction III. In this prediction the main interest was to determine if there are any differences in mental speed, school achievement, persistence or verbal ability among the four groups formed by the possible four-fold classification of the sample in terms of MFF latency and MFF errors medians. Although the F ratio was significant ( $p$  is less than .05) for persistence, achievement and verbal ability, Scheffé test on individual means showed that only reflective and impulsive groups differed significantly in only persistence. The lack of important findings could partly be attributed to the high critical values required by this test. The fact that no differences were found even between



low-error, low-latency and high-error, high-latency groups in achievement suggests that commonsense interpretation of the first group as bright and the second group as dull is questionable.

There seems to be some controversy in psychological literature on some aspects of the research attempted in this study. This refers to the search for relationships between cognitive styles and personality variables. Wright and Kagan (1963) state:

In summary, the way has been paved for initiating theoretically directed research on relationships between traditional personality constructs and individual cognitive processes (p. 195).

In accordance with the above statement a major part of this study was devoted to finding relationships between R-I and several personality variables. As described in Chapter I relationships between R-I and impulsiveness, extraversion, anxiety, agreeing response set, locus of control, neuroticism and persistence were predicted.

Witkin (1963), however, cautions against this common tendency of finding individual differences in performance in one situation and then relating personality variables to these differences.

This represents, I think, what has been a general problem in the study of cognition-personality relationships. Too often individual differences have been prematurely interpreted in personality terms, in advance of adequate study of the contribution made to such differences by characteristics of the situation (p. 119).



Lack of relationship between R-I and the personality variables included in this study demonstrates rather clearly the truth in Witkin's advice. His suggestion regarding a careful analysis of the characteristics of the situation in which reflection is displayed before initiating any relationship studies with personality constructs appears valuable. It would be interesting to see how some changes in the situation as represented by the administration of the MFF would affect latency and error scores. Some of the variables in this situation that would lend themselves to manipulation are: degree of familiarity of the figures, complexity of the figures and the strategy employed in finding the correct response. The degree of motivation could also be manipulated by offering money or some tokens as rewards for correct responses. Although Kagan (1965a) has summarized considerable work on R-I demonstrating the generality and stability of this dimension, it seems more work, on the lines suggested here, is needed to further validate the construct.

In summary it is suggested that reflection-impulsivity is not a broadly based construct, it is specific to situations in the area of cognition where it accounts for only a small amount of common variance depending upon the amount of response uncertainty involved. The major index, response latency, plays a smaller role than that of the minor index, number of errors, in the relationships between







R-I and school achievement, persistence and verbal ability. This calls for a careful re-evaluation of the operational definition of the construct.

On the other hand if the performance on the MFF is accepted as closer to reality since impulsivity is being measured in behavioral terms and treat this as a criterion, then lack of relationship between R-I and other measures of impulsivity (BIS, EPI and ARS) casts doubt on the validity of these measures. These measures are second order removed from behavior as they are reports of behavior.

#### Some Non-hypothesized Considerations

Lack of association between school achievement and socio-economic status deserves a special mention. Traditionally strong relationships have been found between achievement and socio-economic status (Tyler, 1956). It is suggested that present findings may be due to restriction of range in socio-economic status in small towns of Alberta.

Lack of direct association between anxiety and school achievement has been widely reported (Spielberger, 1966 and DeCecco, 1968). Present findings are in agreement with these reports.

Differences between reflective and impulsive children have been reported at different age levels. Most of the studies reviewed earlier have concerned themselves with children ranging from three to twelve years of age. The



present findings at sixteen years of age level do lend support to the hypothesis of stability of relationships of R-I over varying age levels.



## CHAPTER V

### SUMMARY

Kagan (1965a, 1966c) has repeatedly emphasized the importance of reflection-impulsivity (R-I) for education. The main purpose of the present study was to determine relationships between a measure of R-I, Matching Familiar Figures, and several cognitive and personality variables.

Several predictions were made concerning the relatedness of R-I to verbal ability, school achievement, mental speed, analysis, extraversion, neuroticism, risk taking, anxiety, locus of control, agreeing response set, impulsiveness, persistence and socio-economic status.

A battery of tests was administered to 217 high school students. The MFF was individually administered to all the subjects. On the basis of MFF latency and MFF errors scores two groups of subjects reflective and impulsive were identified. The reflective group had significantly higher verbal ability, demonstrated greater persistence and showed better achievement in school subjects.

For the purpose of factor analysis the scores of the subjects who had taken all the tests were divided into two random groups. The intercorrelations of all the seventeen variables for each of the groups were factor analysed and the factor matrices were rotated according to different criteria. Using the most interpretable set of factors, which



included a strong reflection factor, as the target, the factor matrix for the second group was re-rotated in accordance with the Kaiser factor match for maximum overlap with the target matrix. Only factor loadings which replicated in the two groups were interpreted. A factor represented by high positive loadings of MFF latency and high negative loadings of MFF errors was interpreted as the reflection factor. Loadings of sex, achievement, persistence and socio-economic status on this factor ranged from .16 to .47. None of the other variables loaded on this factor.

Little support was found for the prediction concerning a strong common factor of R-I in terms of high loadings of most of the variables. Not only did the personality variables fail to load on the reflection factor, but they loaded on strong meaningful factors that were independent of the reflection factor. In addition to reflection, five other independent factors (anxiety, impulsiveness, achievement-persistence, integrative complexity and incorrect speed) were identified.

It was suggested that R-I is a domain specific variable and it is not related to established personality constructs.

Generally two indices, response latency and number of errors, are jointly employed to identify reflective and impulsive subjects. Response latency has been considered as the more important or the major index of R-I. Since the





minor index of R-I, number of errors, showed a consistent tendency for stronger relationships with other variables than did the major index, response latency, it was suggested that the operational definition of R-I is in need of further consideration.



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